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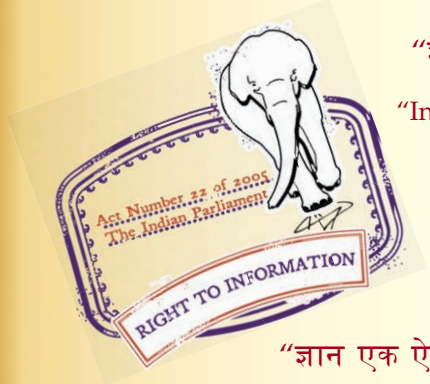
IS 10075 (1981): Start relay and overload protector for resistance start induction run hermetic compressors [ETD 35: Power Systems Relays]



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IS : 10075 - 1981

(Reaffirmed 2001)

Indian Standard

SPECIFICATION FOR START RELAY AND OVERLOAD PROTECTOR FOR RESISTANCE START INDUCTION RUN HERMETIC COMPRESSOR

UDC 621·316:925·4 : 621·51 : 621·56/·59

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Price Rs 6·00

April 1982

Indian Standard

SPECIFICATION FOR START RELAY AND OVERLOAD PROTECTOR FOR RESISTANCE START INDUCTION RUN HERMETIC COMPRESSOR

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Indian Standard

SPECIFICATION FOR START RELAY AND OVERLOAD PROTECTOR FOR RESISTANCE START INDUCTION RUN HERMETIC COMPRESSOR

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 28 December 1981, after the draft finalized by the Relays Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 The function of this device is to operate as a starting device for the resistance start-induction run (RSIR) motor of the refrigeration hermetic compressor and also to disconnect in the shortest possible time power supply to the compressor in the event of abnormal current drawn by the compressor motor and/or overheating of the compressor motor under abnormal operating conditions.

0.3 The design of the starting relay portion of this device is such as to ensure satisfactory starting and running of the compressor motor over its specified operating voltage range and operating conditions. The thermal overload protector portion of the device is designed to protect the compressor motor from damage in the event of overload conditions; it also ensures avoidance of nuisance trippings in the specified operating range.

0.4 The start relay and overload protector combination unit covered by this standard is one of the relays used in the domestic refrigerators, water coolers, deep freezers, bottle coolers and other similar applications.

0.5 This standard provides guidance to the manufacturers and the users for rating and testing the start relay and overload protector for hermetic compressor.

0.6 IS : 9994-1981* has been prepared separately to cover potential relays for capacitor start-capacitor run hermetic compressors.

0.7 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated,

*Specification for potential relays for capacitor start-capacitor run hermetic compressors.

expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the requirements of start relay and overload protector assembled either as a composite unit or mounted separately outside the compressor shell.

1.2 This standard is applicable only to start relay and overload protector used in conjunction with hermetic compressor which has split phase resistance start-induction run motor (RSIR).

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions in addition to those given in IS : 1885 (Part XVII)-1969† and IS : 1885 (Part IX)-1966‡ shall apply.

2.1 Pick-Up Current of a Relay — The minimum increasing value of current in the coil above which the relay contacts will close.

2.2 Drop-Out Current of a Relay — The maximum decreasing value of current in the coil below which the relay contacts will open.

2.3 Overload Protector — A device consisting of a bimetal strip or disc optionally in combination with a heating element capable of automatically disconnecting power to the hermetic compressor in case the compressor motor is overloaded either due to heavy currents or overheat or both during starting or running condition and automatically resets upon cooling of the compressor and/or lowering of the overloading current.

2.4 Type Tests — Tests carried out to prove conformity to the requirements of this specification. They are intended to prove general quality and design of a given type of relay.

2.5 Routine Tests — Tests carried out on each relay to check requirements likely to vary during production.

3. RATINGS

3.1 Rated Current — The value of the current marked on the relay upon which its performance is based. It is the current in the coil of the relay

*Rules for rounding off numerical values (*revised*).
†Electrotechnical vocabulary: Part XVII Switchgear and controlgear.
‡Electrotechnical vocabulary: Part IX Electrical relays.

for which the relay and the overload protector are intended to be used at the rated voltage.

3.2 Maximum Pick-Up Current — The value of maximum pick-up current of the start relay shall be as agreed to between the manufacturer and the user.

3.3 Minimum Drop-Out Current — The value of the minimum drop-out current of this start relay shall be as agreed to between the manufacturer and the user.

3.4 Locked Rotor Current — The value shall be as agreed to between the manufacturer and the user.

4. DESIGN AND CONSTRUCTION

4.1 General

4.1.1 Material used shall be mechanically sturdy and electrically safe and suitable for the particular application and shall be capable of withstanding the mechanical and electrical tests specified in this standard.

4.1.2 All parts must be resistant to rusting and deterioration under conditions of normal use.

4.2 Contacts

4.2.1 The electrical contacts of the overload protector shall be of snap acting type.

4.2.2 The contacts of the start relay as well as the overload protector shall have sufficient capacity to make, carry and break their respective locked rotor current at 110 percent of the rated voltage.

4.2.3 Plug-in Contacts — The plug-in contact design of the combination and other units shall be such as to ensure easy snug fitting upon the compressor glassmatic terminal pins to achieve proper contact resistance and facilitate ease of fitting or dismantling without damage or getting loose in compressor during actual use.

4.3 Clearances and Creepage Distances — The clearances and creepage distances shall be as large as practicable and creepage distances shall, wherever applicable, incorporate ridges, in order to break the continuity of conducting deposits which may form.

4.4 Terminals

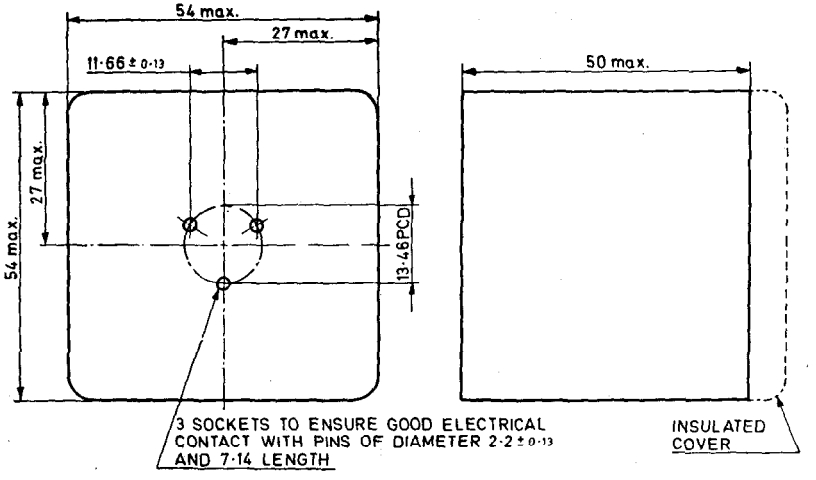
4.4.1 The terminals shall be of substantial mechanical construction and shall provide adequate electrical contacts for the appropriate size of conductors.

4.4.2 The terminals shall be such that they do not turn or get displaced when the connections are made.

4.4.3 The terminals shall be so mounted that the appropriate conductor may be connected without impairing the safe performance of the unit.

4.4.4 The relay (combination unit) may be provided with insulated body cover to avoid electrical shock hazard due to accidental contact with live terminals.

4.5 Overall Dimensions — The preferred overall dimensions for the relay (combination unit) are given in Fig. 1.



All dimensions in millimetres.

FIG. 1 START RELAY AND OVERLOAD PROTECTOR (COMBINATION UNIT)

5. OPERATING CONDITIONS

5.1 Limits of Operation

5.1.1 *Pick-Up Current (of the Start Relay)* — It shall be as agreed upon between the manufacturer and the user.

5.1.2 *Drop-Out Current (of the Start Relay)* — It shall be as agreed upon between the manufacturer and the user.

5.2 Performance of the Overload Protector

5.2.1 *Short Time Locked Rotor Trip Current (under Cold Conditions) at 27°C* — The value of trip time at this current shall be as agreed upon between the manufacturer and the user.

5.2.2 *No-Current Trip Temperature* — The value of the temperature at which the overload protector trips, without carrying any current through the protector, shall be as agreed upon between the manufacturer and the user.

5.2.3 *Ultimate Trip Current of the Overload Protector* — The value of the ultimate trip current at specified temperature shall be as agreed upon between the manufacturer and the user. The value shall be considered at the steady state temperature in the temperature rise condition.

5.2.4 When the overload protector has stabilized to a steady state temperature or predetermined temperature as may be agreed upon between the manufacturer and the user, it shall comply with the requirements given in **7.6.2, 7.6.3** and **7.6.4**.

6. MARKING

6.1 Marking on the device shall be visible and indelible and shall be on the name-plate or on the body.

6.2 Each start relay and overload protector shall be marked with the following:

a) Manufacturer's name or trade-mark,

b) Type designation or serial number,

c) Rated voltage,

d) Mounting position indicating ' top ', and

e) Country of manufacture.

6.3 The device may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

7. TESTS

7.0 General Conditions of Tests

a) Unless specified otherwise in the individual clause, the ambient temperature shall be 43 $\pm$ 1°C.

b) Unless specified or stated otherwise by the manufacturer, each type test shall be carried out on a clean and new device.

c) All the tests shall be done at rated frequency for which the device is intended.

d) For tests, the device shall be mounted and installed as indicated by the manufacturer. The details of installation (type and size of enclosure, if any, size of conductor, etc) shall be indicated in the test report.

7.1 Type Tests — The following shall constitute the type tests:

a) Insulation test (**7.4**);

b) Test for operating limits of the start relay (**7.5**);

c) Test for operating limits and characteristics of overload protector (**7.6**);

d) Test for mechanical endurance (**7.7**);

e) Test for electrical endurance (**7.8**);

f) Make, carry and breaking current capacity of the contacts [pocked rotor current] (**7.9**); and

g) Bump test (under consideration) (**7.10**).

7.2 Routine Tests — The following shall constitute the routine tests:

a) Insulation tests (**7.4**);

b) Test for operating limits of the start relay (**7.5**);

c) Test for operating limits of the overload protector (**7.6**); and

d) Short time locked rotor trip current (cold conductor) (**5.2.1**).

7.3 Acceptance Tests — The sampling procedure for acceptance tests shall be as agreed upon between the manufacturer and the user.

7.3.1 The following shall constitute the acceptance tests:

a) Insulation tests (**7.4**);

b) Test for operating limits of start relay (**7.5**);

c) Test for operating trip ' OFF ' timings of the overload protector limits (**7.6**); and

d) Verification of make, carrry and breaking current capacity of the contacts (locked rotor currents) (**7.9**).

7.4 Insulation Test

7.4.1 *Condition of the Device for Test* — Apart from the general conditions specified in **7.0**, the additional conditions shall be as follows:

a) When the dielectric strength of the device is dependent upon the taping of leads or the use of special insulation, such taping or special insulation shall also be used during the test.

b) Metallic parts shall be placed at all the fixing points in accordance with the conditions of normal installation of the device and these parts shall be considered as a part of the frame of the device.

7.4.2 The test voltage shall be applied for 1 minute between:

a) all the incoming and outgoing terminals connected together and the frame,

b) the incoming and the outgoing terminals of the relay contacts, and

c) the incoming terminals.

The incoming and outgoing terminals of the device are shown in Fig. 2.

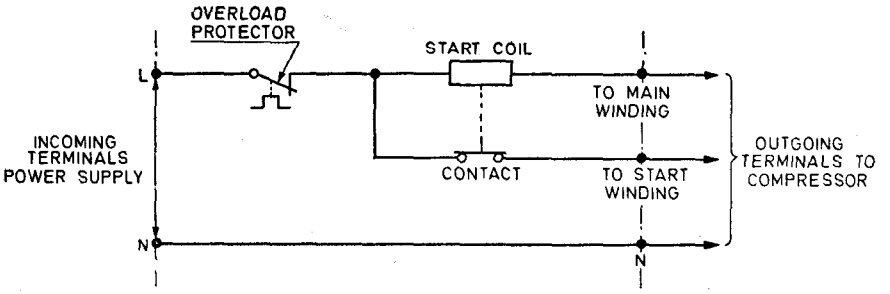


FIG. 2 ILLUSTRATION OF INCOMING AND OUTGOING TERMINALS OF RELAY AND OVERLOAD PROTECTOR (COMBINATION UNIT)

7.4.3 The test voltage shall be of sinusoidal waveform and shall have a frequency between 40 and 60 Hz. The test voltage for type tests shall be $2\ U + 1\ 000$ V rms applied for a period of 1 minute, where U is the rated voltage. For the purpose of routine test, a voltage of 2·5 kV rms shall be applied for a period of 1 second.

7.5 Test for Operating Limits of the Start Relay

7.5.1 The device shall be mounted as required for normal service. This test shall be carried out at an ambient temperature of 27 ± 2°C.

7.5.2 *Pick-Up Current* — Starting from zero, the current in the relay coil shall be increased gradually until it picks up and this value of pick-up current shall be within the limits stated in **5.1.1.** The closing of the relay contacts shall be swift and chatter-free.

7.5.3 *Drop-Out Current* — The current in the relay core after pick-up shall be decreased gradually and the drop-out current shall be recorded

which shall be within the limits stated in **5.1.2**. The opening of the relay contact shall be swift and chatter-free.

7.6 Test for Operating Limits and Characteristics of Overload Protector

7.6.1 The unit under test should be complete and duly assembled with its cover shall be mounted in an oven. The position of the device shall be in accordance with the actual service conditions. Cables of proper size as agreed upon between the manufacturer and the user shall be used while determining the characteristics of the overload protector.

7.6.1.1 *Test oven* — The test oven shall maintain uuiform temperature inside the heating cabinet. The total temperature variation in the cabinet where the overload protector is tested shall not exceed 2°C when measured at two extreme corners, such as front bottom right hand and rear top left hand corners. Any air circulation, hot or otherwise, shall be controlled in such a way that no cold or hot air pockets are created in the oven. Continuous and uniform heating of the oven shall be maintained. The initial rate of uniform temperature rise in the test chamber shall be not more than 5°C per minute until a temperature 5°C below the required temperature is reached. Thereafter, the rate of heating shall be so controlled that the temperature rise shall not be more than 0·5°C per minute. The final test temperature shall be maintained within $\pm$1°C of the temperature stated in **5.2.1**.

7.6.2 *Test for No-Current Trip Temperature* — The device shall be kept in the oven mounted as for normal service and its temperature shall be increased gradually as given in **7.6.1.1**. The protector shall trip within the limits stated for no-current trip temperature.

7.6.3 *Test for Reset Temperature* — In the test for no-current trip temperature (*see* **7.6.2**) after the device trips, the oven shall be switched off and allowed to cool gradually at a rate not more than 1°C per minute. The temperature at which the protector resets shall be recorded and it shall be within the limits stated by the manufacturer.

7.6.4 *Test for Verification of Trip Characteristic of the Overload Protector* — The test shall be carried out to check the conformity to **5.2**. The method of test shall be as agreed upon between the manufacturer and the user.

7.7 Mechanical Endurance Test

7.7.1 *Start Relay* — The relay shall be mounted as for normal service and energized at its rated locked rotor current at a frequency of operation to be stated by the manufacturer. The period of energization of the relay shall be greater than the starting time of the motor with which it is intended to be used. The relay shall withstand satisfactorily 500 000

energization operations without failure. During this test, the relay contacts shall not carry any current.

At the end of the mechanical endurance test, the pick-up/drop-out currents shall be checked and compared with the initial values obtained. The deviations in the values shall not exceed $\pm$ 5 percent.

7.7.2 *Push-On and Pull-Out Force Test (Applicable to Plug-in Contact Relays)* — The plug-in type relays shall be pushed on to the plug on the compressor body. The push-on force for the first insertion shall not exceed 15 kgf. The relay shall be tested to withstand 20 insertions and withdrawals on the compressor body without damage. At the end of the test, the pull-out force for withdrawal of the contacts shall not be less than 2·5 kgf.

7.8 Test for Electrical Endurance of Contacts

7.8.1 The relay shall be mounted as for the normal service. The contacts shall be tested for compliance with the ratings. The contacts shall make or break the current, voltage and power factor of a test circuit simulating the actual service conditions. The test shall be carried out at the rate of 5 operations per minute. The contacts shall work satisfactorily for a minimum of 100 000 operations without excessive burning or pitting of the contacts.

7.9 Make, Carry and Break Current Capacity of Contacts (Locked Rotor Current)

7.9.1 The relay shall be connected in a test circuit to achieve the stated values of make, carry and break current. The voltage shall be 90 percent of the rated voltage of the relay. The duration of test shall be 15 days or 50 000 cycles of operation of opening and closing of the relay contacts, whichever is higher. At the end of the test, the maximum deviation from the initial values of no-current trip temperature and reset temperature shall not be more than $\pm$7 percent. Also, no excessive burning or pitting of the overload and start relay contacts shall take place.

7.9.1.1 At the end of 12 500 operations (25 percent of the test operations), a check shall be made for the values of no-currents trip temperature and reset temperature. If these values differ by more than 7·0 percent of the initial values, further testing shall be suspended.

NOTE — This test shall be carried out at an ambient temperature of 32°C.

7.10 Bump Test — Under consideration.

INDIAN STANDARDS

ON

RELAYS

IS:

1885 Electrotechnical vocabulary
- Part IX-1966 Electrical relays
- Part X-1968 Electrical power system protection

3231-1965 Electrical relays for power system protection

3637-1966 Gas-operated relays

3638-1966 Application guide for gas-operated relays

3842 Application guide for electrical relays for ac systems:
- Part I-1967 Overcurrent relays for feeders and transformers
- Part II-1966 Overcurrent relays for generators and motors
- Part III-1966 Phase unbalance relays including negative phase sequence relays
- Part IV-1966 Thermal relays
- Part V-1968 Distance protection relays
- Part VI-1972 Power relays
- Part VII-1972 Frequency relays
- Part VIII-1976 Voltage relays
- Part IX-1977 Relays for busbar protection
- Part X-1976 Relays for transverse differential protection
- Part XII-1976 Differential relays for transformers

4483 (Part I)-1968 Preferred panel cutout dimensions for electrical relays:
- Part I Flush mounting IDMTL relays

5834 Electrical timer relays for industrial purposes:
- Part I-1973 Pneumatic
- Part II-1973 Motorized
- Part III-1981 Electronic

8686-1977 Static protective relays

8714-1978 Electrical protective relays for use in seismic areas

9124-1979 Guide for maintenance and field testing of electrical relays